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Dislocation structure evolution during plastic deformation of low-carbon steel

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Abstract

© 2016 Raab et al.In this paper, the regularities of structure formation in low-alloyed carbon steels are analyzed. They coincide to a large extent with the general views on the effect of strain degree on the evolution of deformation structure. In ferrite grains, not only the qualitative picture of changes, well known for Armco iron, is repeated, but also the quantitative values of strain corresponding to a change in the structural state are repeated as well. When investigating samples of a ferriticpearlitic steel, it is found that structure formation in pearlite essentially lags behind structural changes in ferrite grains, and this delay is observed at all stages of deformation. An important feature of structure formation in pearlite is crack nucleation in cementite, accompanied by dislocation pile-up in the ferrite interlayers of pearlite. Using the method of dislocation dynamics, the relationship between structural transformations and the parameters of strain hardening is analyzed. It is demonstrated that the proposed method of computer analysis reflects well the processes taking place in a material during plastic deformation. The character of the theoretical curve of strain hardening is determined by the dislocation structure that forms in a material at various stages of deformation.

Keywords

Evolution of dislocation structure, Low-alloyed carbon steels, Method of dislocation dynamics, Strain degree, Strain hardening